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The lichen genus *Graphis* from Vietnam

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ABSTRACT — The status of *Graphis* (*Ostropales*: *Graphidaceae*) in Vietnam is presented, based on literature and observation of recently collected specimens. Eleven new records of the genus are described for the country. All important diagnostic characters of species are documented and supported by distribution, ecology, and illustrations. A key to the seventeen *Graphis* species in Vietnam is also provided.

KEY WORDS — evergreen forest, National Park, taxonomy, tropical

Introduction

The broad tropical continental biota experienced a long, undisturbed evolution that resulted into rich composition of old and mature forests (Chazdon & Whitmore 2002). According to general consensus the tropical old forests have a vast diversity of corticolous lichenized ascomycetes, particularly those of *Graphidaceae* (Aptroot & Sipman 1997; Sipman & Aptroot 2001; Feuerer & Hawksworth 2007; Archer 2009; Lücking et al. 2009, 2011; Rivas Plata et al. 2008, 2010, 2012). Vietnam, being placed in the tropical belt, contains dense continuous old forests exposed to a high and constant temperature regime and a prolonged humid climate. The Vietnamese northern and central high land ecosystems present an array of forest types, from deciduous to mixed deciduous and evergreen forest cover, mostly restored after the regions were declared National Parks (Jong et al. 2006). In Vietnam, there has not been much significant research on *Graphidaceae*. A more or less exhaustive account on Vietnam lichen mycota was published by Aptroot & Sparrius (2006) as a checklist, which accepts ca. 30 species of *Graphidaceae* (including thelotremoid taxa) for the country.

Graphis Adans., the largest graphidoid genus, comprises more than 300 species world-wide (Lücking et al. 2009). The genus, which has not thoroughly studied in Vietnam, is represented by only six species: *Graphis caesiella* Vain., *G. dussii* Vain., *G. leptogramma* Nyl., *G. librata* C. Knight, *G. proserpens* Vain., and *G. rimulosa* (Mont.) Trevis. In order to clarify the *Graphis* diversity in the country, a survey was conducted of three National Parks situated in northern and central highlands (FIG. 1A). About 400 specimens were collected from all three parks, including approximately 50 graphidaceous species representing *Acanthothecis*, *Diorygma*, *Fissurina*, *Graphis*, *Hemithecium*, *Platygramme*, *Sarcographa*, *Sarcographina*, and *Thecaria*. Our examination of the *Graphis* specimens has revealed eleven species new to Vietnam. Although the recorded *Graphis* species in no way encompass the full phytogeographical diversity of *Graphis* in Vietnam, they certainly indicate that many more species will be discovered in the country's tropical rain forests.

All species reported here share some common characteristics peculiar to *Graphis*: lirellate ascomata; carbonized proper exciple; non-amyloid (I–) hymenium; functionally unitunicate asci with apical wall thickening; simple, rather lax, apically granulate, $\pm$ conglutinate, 1–2 μ m thick paraphyses; hyaline and amyloid (I+ blue), trans-septate to muriform ascospores with lens-shaped lumina; and *Trentepohlia* as photobiont (Archer 2009; Lücking et al. 2009). Ecologically, *Graphis* was reported mostly on the trees in secondary old growth forest and serves as a good indicator of forest health in National Parks in Vietnam.

The present account briefly describes the 11 *Graphis* species newly reported from Vietnam

Materials & methods

Chu Yang Sin, Yok Don, and Tam Dao National Parks of Vietnam were surveyed for their lichen diversity assessment in April 2012. The collected samples were preserved in lichen herbarium of Korean Lichen Research Institute, South Korea (KoLRI). The specimens were segregated up to generic level, and the members of *Graphis* were identified morphologically, anatomically and chemically. Morphological and anatomical characters of thallus and ascomata were observed under SMZ-168 (China) dissecting and OLYMPUS BX50 (Tokyo, Japan) compound microscopes. The terminology for lirellae morphology follows Lücking et al. (2009). Lugol's solution (I) was used to check the amyloidity of ascospores. All measurements were taken on thin hand-cut sections of ascomata mounted in tap water. For color spot reaction tests and thin layer chromatography (TLC), methodology provided by Orange et al. (2010) was followed. For TLC, solvent system C (toluene 85%, acetic acid 15%) was used. The key characters of the species were determined by consulting recent literature on *Graphis* (Staiger 2002; Archer 2009; Lücking et al. 2009).

Taxonomy

Graphis caesiocarpa Redinger, Ark. Bot. 27A(3): 23, 1935.

PL. 1B

Thallus corticolous, epiperidermal, crustose, continuous, rough, whitish or creamy grey, 100–150 µm thick in cross section; cortex layer indistinct to absent; algal layer indistinct to 10 µm; medulla epi- to endoperidermal, densely studded with crystals, ≤140 µm; prothallus blackish.

Ascomata lirelliform, immersed; lirellae scattered, 5–10 mm long, black; labia entire, whitish to creamy pruinose; disc slit-like, concealed (*caesiella*-morph); proper exciple completely carbonized, convergent, ± round, 50–140 µm wide, basally sometimes merged with hypothallus; epihymenium indistinct to absent; hymenium clear, 100–120 µm high; hypothecium hyaline, indistinct to 20 µm high; ascus clavate, 8-spored; ascospores hyaline, fusiform, mostly transversely 15–20-loculate, 50–70(–80) × 10–11 µm.

CHEMISTRY: K+ yellow turning red, PD+ yellow-orange, C–; norstictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Neotropics and Eastern Palaeotropics (Lücking et al. 2009); in Vietnam, it was found growing at 700–800 m with other *Graphis* and *Diorygma* species on tree trunks at medium height.

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Yok Don National Park, 12°51'20.0"N 107°45'58.1"E, alt. ca. 760 m, on tree, 22 April 2012, Hur & Oh VN120214–1 (KoLRI).

REMARKS: *Graphis assimilis* Nyl. has a similar distribution and also contains norstictic acid but differs from *G. caesiocarpa* in short and sparsely branched lirellae (*lineola*-morph). The ascospore size of the examined material, which exceeds the range cited in Lücking et al. (2009), reaches that of *G. marginata* Raddi, which has entirely different lirellae morphology (*marginata*-morph). Pending additional collections, the material is provisionally placed in *G. caesiocarpa*.

Graphis cervinonigra Zahlbr., Feddes Repert. 31: 210, 1933.

PL. 1C

Thallus corticolous, epiperidermal, crustose, continuous, ± smooth, ± brownish green to grey-green, 100–150 µm thick in cross section; cortex layer 15–20 µm; algal layer continuous, 20–40 µm; medulla mostly endoperidermal, 80–100 µm, with inclusions of crystals; prothallus indistinct to blackish.

Ascomata lirelliform, prominent; lirellae aggregate, 5–7 mm long, black, ± stellately branched (*coarctata*-morph); labia entire, epruinose; disc slit-like, concealed; proper exciple completely carbonized, convergent, ± round, 65–75 µm wide; epihymenium indistinct to absent; hymenium inspersed, 100–120 µm high; hypothecium hyaline, indistinct to 20 µm high; ascus clavate, 8-spored; ascospores hyaline, fusiform, mostly transversely 9–10-loculate, 20–35 × 6–8 µm.

CHEMISTRY: K+ yellow turning red, PD+ yellow-orange, C–; norstictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Eastern Palaeotropics (Lücking et al. 2009); in Vietnam, *Graphis cervinonigra* was reported at 70–1000 m on tree bark in evergreen forest. The other lichens growing in surrounding environment were the members of *Diorygma*, *Letrouitia*, and *Ocellularia*.

SPECIMENS EXAMINED: VIETNAM. VINH PHUC PROVINCE: Tam Dao National Park, Tay Thien Mt., 21°26'52.2"N 105°38'10.8"E, alt. ca. 936 m, on tree, 26 April 2012, Hur & Oh VN120372, VN120374 (KoLRI); 21°27'10.8"N 105°38'58.2"E, alt. ca. 77 m, on tree, 25 April 2012, Hur & Oh VN120349 (KoLRI).

REMARKS: The species resembles *Graphis centrifuga* Räsänen in having branched lirellae, entire labia, completely carbonized proper exciple, transversely septate ascospores, norstictic acid in thallus, and a similar geographical distribution. *Graphis centrifuga* differs in long, radially branched lirellae and smaller ascospores. *Graphis gonimica* Zahlbr. shares similar anatomical and chemical characters but differs from *G. cervinonigra* in sparsely to irregularly branched lirellae (*lineola*- or *deserpens*- morph).

Graphis cycasicola A.W. Archer & Elix, Australas. Lichenol. 61: 19, 2007. PL. 1D

Thallus corticolous, epiperidermal, crustose, continuous, smooth, ± bulging (due to bark texture), whitish-grey or green to grey-green, 170–200 µm thick in cross section; cortex layer distinct, 10–15 µm; algal layer continuous, 30–50 µm; medulla mostly endoperidermal, studded with crystals; prothallus indistinct to blackish.

Ascomata lirelliform, emergent; lirellae scattered, simple, straight to sinus, short to 5 mm long, branched, with thick, complete thalline margin (*subserpentina*-morph); labia entire; disc slit-like, concealed; proper exciple completely carbonized, convergent, ≤170 µm wide; epihymenium ≤15 µm, greyish, granular; hymenium clear, 120–150 µm high; hypothecium hyaline, indistinct to 20 µm high; ascus clavate, 1-spored; ascospores hyaline, ellipsoidal, muriform, multicelled, 80–110 × 25–40 µm.

CHEMISTRY: K+ yellow turning red, PD+ yellow-orange, C–; norstictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Eastern Palaeotropics (Lücking et al. 2009); in Vietnam, the species was growing luxuriantly at 700–800 m above chest height on thick rough tree trunks.

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Yok Don National Park, 12°51'20.0"N 107°45'58.1"E, alt. ca. 760 m, on tree, 22 April 2012, Hur & Oh VN120216 (KoLRI).

REMARKS: Both morphologically as well as chemically, *G. cycasicola* is similar to *G. subserpentina*, which is distinguished by a laterally carbonized proper exciple.

Graphis epiphloea Zahlbr., Feddes Repert. 31: 210, 1933.

PL. 1E

Thallus corticolous, epiperidermal, crustose, continuous, smooth, shiny, green to greyish-green, 100–300 μm thick in cross section; cortex layer 20–25 μm ; algal layer continuous, 30–50 μm ; medulla mostly endoperidermal; prothallus indistinct.

Ascomata lirelliform, $\pm$ immersed; lirellae aggregate, radially branched, ≤ 20 mm long, covered by thick complete thalline margin (*subserpentina*-morph); labia entire; disc slit-like, concealed; proper exciple apically carbonized, convergent, ≤ 60 –70 μm wide; epihymenium ≤ 15 μm , greyish, granular; hymenium clear, 150–170 μm high; hypothecium hyaline, ≤ 40 μm high; ascus clavate, 6–8-spored; ascospores hyaline, fusiform, transversely septate, 15–20-loculate, 90 – $100(-140) \times 18$ –20 μm .

CHEMISTRY: K+ yellow, PD+ yellow-orange, C–; stictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Eastern Palaeotropics (Lücking et al. 2009); in Vietnam, the species was collected at ca. 1000 m from a tree trunk above chest level.

SPECIMEN EXAMINED: VIETNAM. VINH PHUC PROVINCE: Tam Dao National Park, 21°27'21.7"N 105°39'00.8"E, alt. ca. 1092 m, on tree, 25 April 2012, Hur & Oh VN120319 (KoLRI).

REMARKS: *Graphis valparaiensis* Adaw. & Makhija also produces entire labia, apically carbonized proper exciple, clear hymenium, transversely septate large ascospores, and stictic acid but differs from *G. epiphloea* in sparsely branched lirellae with lateral thalline margin (*lineola*-morph). The examined material was rather poor, and further collection of the material is needed.

Graphis handelii Zahlbr., Symb. Sinic. 3: 44, 1930.

PL. 1F

Thallus corticolous, epiperidermal, crustose, continuous, $\pm$ smooth, green to grey-green, 100–150 μm thick in cross section; cortex layer 10–15 μm ; algal layer continuous, 30–40 μm ; medulla 80–100 μm to mostly endoperidermal, with inclusions of crystals; prothallus indistinct to blackish.

Ascomata lirelliform, prominent; lirellae aggregate, short to 5 mm long, black, unbranched; labia entire, epruinose; disc exposed, epruinose (*handelii*-morph); proper exciple laterally carbonized, convergent, 50–70 μm wide; epihymenium indistinct to absent; hymenium inspersed, ≤ 100 μm high; hypothecium indistinct; ascus clavate, 8-spored; ascospores hyaline, fusiform, transversely septate, 9–10-loculate, 20 – 30×6 –7 μm .

CHEMISTRY: K+ yellow turning red, PD+ yellow-orange, C–; norstictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Pantropical (Lücking et al. 2009); in Vietnam, the species was collected below 100 m from smooth barked trees, where it was growing with members of the lecanoroid and lecidoid groups.

SPECIMENS EXAMINED: VIETNAM. VINH PHUC PROVINCE: Tam Dao National Park, Tay Thien Mt., 21°27'53.3"N 105°35'06.6"E, alt. ca. 77 m, on tree, 26 April 2012, Hur & Oh VN120389, VN120390, VN120392 (KoLRI).

REMARKS: *Graphis crebra* Vain. and *G. aperiens* Müll. Arg., which are most similar to *G. handelii*, have distinctly white pruinose ascomatal discs (*scripta*-morph). Moreover, *G. aperiens* has a completely carbonized proper exciple. The examined material could be confused with *G. plumierae* Vain., which has pruinose labia with closed ascomatal discs (*caesiella*-morph) and a different geographical distribution.

Graphis japonica (Müll. Arg.) A.W. Archer & Lücking, Lichenologist 41: 437, 2009.

PL. 1G

Thallus corticolous, epiperidermal, crustose, continuous, bulging (due to bark texture), smooth to ± verrucose, shiny, grey-green, pale-green or yellowish green, ≤170 µm thick in cross section; cortex layer 20–30 µm; algal layer continuous, 50–60 µm; medulla epi to endoperidermal, ≤100 µm; prothallus indistinct to blackish.

Ascomata lirelliform, ± immersed; lirellae intensely branched, branching leads the length of lirellae ≤30 mm, covered by thick complete and bulging thalline margin (*subserpentina*-morph); labia entire; disc slit-like, concealed; proper exciple apically to laterally carbonized, convergent, ≤20–70 µm wide; epihymenium ≤10 µm, greyish, granular; hymenium clear, 150–170 µm high; hypothecium hyaline, 30–40 µm high; ascus clavate, 2–8-spored; ascospores hyaline, ellipsoidal, muriform, 10–15 × 4–6 loculate, 70–80 × 18–22 µm.

CHEMISTRY: K+ yellow, PD+ yellow-orange, C–; stictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Eastern Palaetropics (Lücking et al. 2009); in Vietnam, the species was collected at 600–800 m, where it was largely spread over thick tree trunks in an evergreen forest, usually below chest level.

SPECIMENS EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, 12°28'04.4"N 108°20'39.0"E, alt. ca. 622 m, on tree, 20 April 2012, Hur & Oh VN120062 (KoLRI); 12°27'57.0"N 108°20'34.9"E, alt. ca. 780 m, on tree, 21 April 2012, Hur & Oh VN120139 (KoLRI).

REMARKS: *Graphis japonica* is a distinct species with pale-green to grey-green thallus and a very long branched lirellae, which sometimes appear as grooves on tree bark. The similar *G. streblocarpa* (Bél.) Nyl. differs in 1–2-spored asci and a Neotropical distribution (Lücking et al. 2009).

Graphis renschiana (Müll. Arg.) Stizenb., Ber. Thätigk. St. Gallischen Naturwiss.

Ges. 1889–90: 184. 1891.

PL. 1H

Thallus corticolous, epiperidermal, crustose, continuous, ± smooth, green to grey-green, ≤100 µm thick in cross section; cortex layer indistinct to 10 µm;

algal layer continuous, 20–30 μm ; medulla 30 μm to mostly endoperidermal, with inclusions of crystals; prothallus indistinct.

Ascomata lirelliform, immersed to erumpent; lirellae radially to irregularly branched (*deserpens*-morph), 10–15 mm long, black; labia entire; disc concealed; proper exciple laterally carbonized, convergent, 40–50 μm wide; epihymenium indistinct to absent; hymenium clear, ≤ 100 μm high; hypothecium 20–25 μm high; ascus clavate, 2–8-spored; ascospores hyaline, ellipsoidal, muriform, 7–10 $\times$ 5–6-loculate, 18–25 $\times$ 6–8 μm .

CHEMISTRY: K+ yellow turning red, PD+ yellow-orange, C–; norstictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Pantropical (Lücking et al. 2009); in Vietnam, the species was collected at 700–800 m, where it was growing luxuriantly with other graphidoid taxa above chest level.

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, 12°27'50.0"N 108°20'34.9"E, alt. ca. 780 m, on tree, 21 April 2012, Hur & Oh 120141 (KoLRI).

REMARKS: The over mature ascomata of *G. renschiana* are slightly striate as in *G. neoelongata* Lücking, which also contains norstictic acid but differs in also producing stictic acid and its occurrence limited (thus far) to the Neotropics (Lücking et al. 2009). The other similar species, *G. nadurina* Aptroot, differs in prominent, unbranched, very short lirellae with apically thick, complete thalline margin (*cleistomma*-morph). The lirellae of the observed specimen do not fully agree with the description in *G. renschiana* and so additional collections are needed to clarify the identification.

Graphis schroederi Zahlbr., Ann. Mycol. 19: 228, 1921.

PL. 11

Thallus corticolous, epiperidermal, crustose, continuous, $\pm$ smooth, green to grey-green, 200–250 μm thick in cross section; cortex layer distinct, ≤ 20 μm ; algal layer continuous, 30–50 μm ; medulla mostly endoperidermal, 140–180 μm , with inclusions of crystals; prothallus indistinct to blackish.

Ascomata lirelliform, prominent; lirellae aggregate, radially branched, apically covered by thick thalline margin (*subserpentina*-morph), 5–10 mm long, black; labia entire; disc concealed; proper exciple completely carbonized, convergent, 30–60 μm wide, basally merged with hypothallus; epihymenium indistinct to absent; hymenium clear, ≤ 200 μm high; hypothecium indistinct; ascus clavate, 8-spored; ascospores hyaline, fusiform, transversely septate, 14–23-loculate, 70–90(–130) $\times$ 14–17 μm .

CHEMISTRY: K+ yellow, PD+ yellow-orange, C–; stictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Palaeotropics (Lücking et al. 2009); in Vietnam, the species was collected at 900–1000 m from smooth barked trees.

SPECIMEN EXAMINED: VIETNAM. VINH PHUC PROVINCE: Tam Dao National Park, 21°27'13.1"N 105°38'51.2"E, alt. ca. 990 m, on tree, 25 April 2012, Hur & Oh VN120310 (KoLRI).

REMARKS: The sympatric *G. subassimilis* Müll. Arg. also has entire labia, completely carbonized proper exciple, clear hymenium, transversely septate ascospores, and stictic acid but differs from *G. schroederi* in comparatively smaller ascospores, lateral thalline margin, and pruinose labia (*caesiella*-morph). The other similar species, *G. rustica* Kremp., differs from *G. schroederi* in elongate and irregularly branched lirellae with thick lateral thalline margins (*marginata*-morph).

Graphis subserpentina Nyl., Acta Soc. Sci. Fenn. 7: 465, 1863.

PL. 1J

Thallus corticolous, epiperidermal, crustose, continuous, smooth, crystalline, whitish-green to creamy green or off-white, ≤ 150 μm thick in cross section; cortex layer indistinct; algal layer continuous, 100–130 μm ; medulla mostly endoperidermal, studded with crystals; prothallus blackish.

Ascomata lirelliform, $\pm$ erumpent; lirellae aggregate, irregularly branched, 5 to 7 mm, covered by lateral thalline margin (*subserpentina*-morph); labia entire; disc slit-like, concealed; proper exciple laterally carbonized, convergent, ≤ 230 μm wide in mature ascomata; epihymenium indistinct; hymenium clear, 125–150 μm high; hypothecium hyaline, ≤ 40 μm high; ascus clavate, 1-spored; ascospores hyaline, ellipsoidal, muriform, multicelled, $80\text{--}100 \times 20\text{--}25$ μm .

CHEMISTRY: K⁺ yellow turning red, PD⁺ yellow-orange, C⁻; trace of norstictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Palaeotropics (Lücking et al. 2009); in Vietnam, the species was recorded from tree bark at 300–400 m.

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Yok Don National Park, 12°51'20.0"N 107°45'58.1"E, alt. ca. 760 m, on tree, 22 April 2012, Hur & Oh VN120215 (KoLRI).

REMARKS: *Graphis subserpentina* morphologically resembles *G. streblocarpa*, which differs in containing stictic acid. The chemically similar *G. insulana* (Müll. Arg.) Lücking & Sipman has an inspersed hymenium.

Graphis subvittata Adaw. & Makhija, Mycotaxon 99: 322, 2007.

PL. 1K

Thallus corticolous, epiperidermal, crustose, continuous, $\pm$ smooth (appears uneven due to bark texture), grey-green to greyish, 140–200 μm thick in cross section; cortex ≤ 20 μm ; algal layer continuous, 20–30 μm ; medulla 100–150 μm , with inclusions of crystals; prothallus blackish.

Ascomata lirelliform, erumpent to prominent; lirellae mostly scattered to aggregate, irregularly branched, with basal to lacking thalline margin (*striatula*-morph), ≤ 10 mm long, black; labia striate; disc concealed; proper exciple peripherally carbonized, convergent, 40–80 μm wide; epihymenium indistinct

to absent; hymenium clear, ≤ 100 μm high; hypothecium distinct, 20–25 μm high; ascus clavate, 8-spored; ascospores hyaline, fusiform, transversely septate, 9–10-loculate, $20\text{--}30 \times 6\text{--}7$ μm .

CHEMISTRY: K+ yellow turning red, PD+ yellow-orange, C–; norstictic acid and traces of stictic acid detected in TLC.

DISTRIBUTION & ECOLOGY: Eastern Palaetropics (Lücking et al. 2009); in Vietnam, the species was collected from rough bark of trees, where it was spreading luxuriantly at an altitude between 700–800 m.

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, $12^{\circ}27'50.0''\text{N}$ $108^{\circ}20'34.9''\text{E}$, alt. ca. 780 m, on tree, 21 April 2012, Hur & Oh VN120184 (KoLRI).

REMARKS: *Graphis subvittata* is most similar in thallus compound and lirellae morphology to *G. nigroglaucia* Leight., which differs in larger ascospores and lacking a thalline margin. The examined specimen is comparable to *G. schiffneri* Zahlbr. in striated labia and the presence of norstictic acid, but *G. schiffneri* has a completely carbonized exciple and *tenella*-morph lirellae and lacks stictic acid.

Graphis supracola A.W. Archer, Austral. Syst. Bot. 14: 267, 2001.

PL. 11

Thallus corticolous, epiperidermal, crustose, continuous, smooth, greyish-green, thin, 70–100 μm thick in cross section; cortex layer indistinct to absent; algal layer continuous, 40–60 μm ; medulla mostly endoperidermal, indistinct, studded with crystals; prothallus indistinct to blackish.

Ascomata lirelliform, immersed; lirellae scattered, radially branched, 5 to 10 mm long, with thin lateral thalline margin; labia entire, thinly white pruinose (*caesiella*-morph); disc slit-like, concealed; proper exciple completely carbonized, convergent, $\leq 30\text{--}80$ μm wide; epihymenium ≤ 15 μm , brownish, granular; hymenium clear, ≤ 100 μm high; hypothecium hyaline, ≤ 20 μm high; ascus clavate, 8-spored; ascospores hyaline, ellipsoidal, transversely septate, $20\text{--}30 \times 7\text{--}8$ μm .

CHEMISTRY: K–, PD+ yellow-orange, C–; protocetraric acid detected in TLC.

DISTRIBUTION & ECOLOGY: Pantropical (Lücking et al. 2009); in Vietnam, the species was recorded near a waterfall, where it was growing in small patches with *Letrouitia leprolytoides* S.Y. Kondr. & Elix and other crustose species on thick rough tree bark at 300–400 m.

SPECIMEN EXAMINED: VIETNAM. DAK NONG PROVINCE: Dray Nur Waterfall, $12^{\circ}33'06.3''\text{N}$ $107^{\circ}73'19.6''\text{E}$, alt. ca. 371 m, on tree, 19 April 2012, Hur & Oh VN120008 (KoLRI).

REMARKS: The examined material of *G. supracola* was rather small, but identifiable. It agrees well with all diagnostic characters except thallus color,

which Archer (2009) described as pale-fawn. The similar *G. distincta* Makhija & Adaw. differs in exposed pruinose ascomatal discs and containing stictic and constictic acids as an additional compounds.

Key to *Graphis* species recorded from Vietnam

The six previous records and eleven new records from Vietnam are summarized in this key. Diagnostic characters of the earlier recorded species are from Lücking et al. (2009).

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14. Stictic and hypostictic acids present; lirellae narrow, with gently sloping lateral thalline margin; ascospores 44–65 μm long *G. leptogramma*
14. Norstictic acid present15

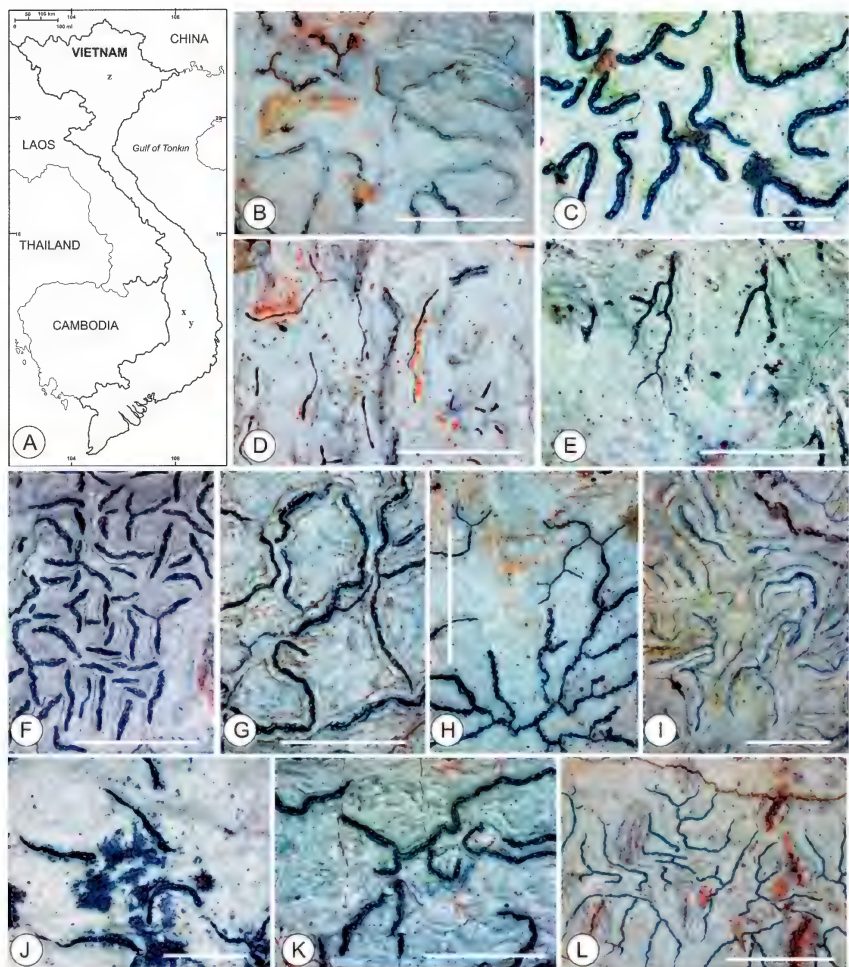


PLATE 1. A. Map of Vietnam showing collection sites in northern and central highlands (x = Chu Yang Sin NP; y = Yok Don NP; z = Tam Dao NP); B. *Graphis caesiocarpa*; C. *G. cervinonigra*; D. *G. cycasicola*; E. *G. epiphloea*; F. *G. handelii*; G. *G. japonica*; H. *G. renschiana*; I. *G. schroederi*; J. *G. subserpentina*; K. *G. subvittata*; L. *G. supracola*. Scale bars: B–D, F–L = 5 mm; E, G = 10 mm.

- 15. Lirellae prominent to sessile, with thick lateral thalline margin, very short and unbranched; corticolous. *G. dussii*
- 15. Lirellae immersed to erumpent; corticolous and saxicolous 16
- 16. Lirellae elongate and irregularly branched; labia distinctly white pruinose *G. caesiella*
- 16. Lirellae short and sparsely branched; labia epruinose. *G. librata*

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